NEW YORK STATE DEPARTMENT OF TRANSPORTATION MATERIALS BUREAU ALBANY, NY 12232 **MATERIALS METHOD**	MATERIALS METHOD: NY 12 ISSUE DATE: 2/23/87 Supersedes: MM NY 12 dated 6/68
SUBJECT: CORRUGATED METAL PIPE AND CORRUGATED STRUCTURAL PLATE FOR PIPE	
APPROVED: James J. Murphy JAMES J. MURPHY, Director, Materials Bureau	CODE: 7.42-1-12

I. SCOPE

This Method describes procedures for the Department's quality assurance program for the following items:

Round Corrugated Steel Pipe & Pipe Arches
Steel Pipe Underdrain
Corrugated Structural Steel Plate For Pipe, Pipe Arches And Underpasses
Galvanized Steel End Sections
Perforated Corrugated Aluminum Pipe Underdrain
Round Corrugated Aluminum Pipe, Pipe Arches & End Sections
Corrugated Aluminum Structural Plate For Pipe & Pipe Arches
Smooth Lined Corrugated Steel Pipe
Smooth Lined Corrugated Aluminum Pipe

It encompasses a quality assurance program whereby material is accepted by certification, and inspection at the project site.

This Method supersedes all previous instructions issued for the above listed materials.

II. CONTENTS

Page

DEFINITION OF TERMS 3

GENERAL METHOD 5

ACCEPTANCE PROCEDURE 6

INSPECTION OF PIPE OR PLATE. 7

TABLE 1. 15

TABLE 2. 16

SKETCH 1, 2, AND 3 17

ANNUAL CERTIFICATION FORM SAMPLE 18

BR-355 FORM SAMPLE 19

III. DEFINITIONS

1. Supplier - A fabricating company engaged in the production of corrugated metal pipe products from metal sheeting material. Also a division thereof that sells, delivers and certifies corrugated metal pipe products to buyers. To qualify as a supplier the division, must also be engaged in performing additional work to complete the manufacture of the pipe and/or pipe accessories.

2. Sheet Manufacturer - A company engaged in the production of the metal sheeting material.

3. Department - The New York State Department of Transportation.

4. Region or Regional Office - One of eleven geographical subdivisions of the State used to designate or identify the location of the proposed work.

5. Regional Director - The Director, acting through the Commissioner, who is delegated the authority and responsibility to execute the total Department prescribed work plans for his respective region.

6. Materials Bureau - A Bureau within the Department which may be contacted by mailing to:

   Materials Bureau
   State Campus, Bldg. 7A
   1220 Washington Ave.
   Albany, New York 12232

   or telephoning the Materials Administration section of the Materials Bureau at:

   Area Code 518
   Phone Number 457-5642

7. Project Inspector - The Department of Transportation representative detailed to supervise or inspect methods and materials relating to work both on and off the site of the contract.

8. Regional Materials Inspector - An individual from the Regional Materials Section assigned to function on inspection assignments at the project.

9. Domestic Steel - All steel manufacturing processes must be performed in the United States and its possessions or territories. The ore, scrap, and pig iron may be foreign or domestic; however, transformation into steel and all subsequent processes and fabrication must be performed in the United States and its possessions or territories.

NYSDOT
Library
50 Wolf Road, POD 34
Albany, New York 12232

10. Annual Certification - An official document, prepared by the sheet or plate manufacturer and forwarded to the Materials Bureau by the Supplier. This document shall include the following minimum information:

    a. The Sheet Manufacturer's name and address.

    b. The date of execution.

    c. The material supplied and the AASHTO designation to which it complies as specified in the Standard Specifications.
    d. The chemical composition of the metal.
    e. The type of any metallic and/or polymer coatings.
    f. A definite statement included for items containing steel certifying the domesticity in accordance with the previous definition, as required.
    g. The signature of an official or officer of the Sheet Manufacturer having legal authority to bind the company.
    h. A statement by the Supplier assuring that the base metal material to be supplied that year is represented by this certification. Should the base metal supply change during the year, the Supplier shall notify the Materials Bureau and an updated certification shall be required.

11. Certification for Corrugated Pipe Items - An official document, prepared by the Supplier, that accompanies each individual shipment to a Department project location. This document shall include the following minimum information:

    a. The Supplier's name and location. If applicable the Polymer Coating Brand Name and Polymer Coating Applicator's name and location.

    b. The content of the shipment, project destination, date the shipment was made. The content of the shipment shall include the diameter, gauge and length of pipe; and gauge, number and type of piece for plate.

    c. A definite statement included for items containing steel certifying the domesticity in accordance with the previous definition, as required.

    d. A definite statement that the material in the shipment conforms to the Department's specification requirements.

    e. The certification shall be signed by a representative of the Supplier having the authority to legally bind the company. It is not necessary that such signature be notarized. A sample form is included for the Supplier's information, see page 18. This form may be duplicated by the Supplier for use or he may use his own form provided it contains all the same information.

IV. GENERAL METHOD

The products described in the SCOPE section of this Method will be accepted under Department Specifications when the Supplier of each product has filed with the Department's Materials Bureau an acceptable annual certification executed by the Sheet or Plate Manufacturer of each brand of metal to be supplied.

Such Annual Certification shall be executed in conformance with the applicable procedures referenced herein and the Standard Specifications for each item.

The Materials Bureau will accept the Annual Certification before or after fabrication, but prior to the item's installation. It shall be filed with the Materials Bureau between January 1st and February 15th of each year.

In April and October of each year, the Materials Bureau will publish and distribute to all Regional Offices of the Department an Approved List of Suppliers who have complied with specification requirements. This approved list is updated as necessary. A letter from the Director, Materials Bureau indicating addition to the Department's Approved List will be evidence of acceptability until the issuance of the next Approved List.

Products from Suppliers who do not appear on the current Approved List are not acceptable.

At the time of a Supplier's delivery to a Department project location, each individual shipment must be accompanied by a Certification for Corrugated Pipe Items.

All copies of Certification for Corrugated Pipe Items and test results shall be maintained on file by the Supplier for a minimum period of seven years and be made available to the Department upon request.

Receipt of a properly executed Certification for Corrugated Pipe Items with each individual shipment will constitute evidence of acceptability of that shipment at the project site. In addition, the shipment will be inspected at the project site.

The Department will also pursue a program of random monitoring which may include sampling at fabricating shop locations to assure conformance with procedures and specifications.

Inspections of pipe and/or plate will be made at the project site as described in the Inspection of Pipe or Plate section of this Materials Method.

If any pipe and/or plate measured does not meet specified dimensions, it shall be rejected along with all other pipes and plates it represents. As noted in the following acceptance procedure, the Region Materials Inspector shall notify the Materials Bureau of any rejections. This may be cause for removal of the Supplier from the Department's Approved List.

V. ACCEPTANCE PROCEDURE

Responsibility	Action
Supplier	1. Sends Annual Certification documents to the Materials Bureau between January 1 and February 15 of each year.
Materials Bureau	2. Publishes an Approved List of Suppliers, Applicators and Polymer film that have complied with the specific requirements, the List being distributed to Regional Offices in April and October of each year.
Supplier	3. Delivers fabricated material to Department project sites, each delivery being accompanied by a Certification for Corrugated Pipe Items.
Project Inspector	4. Checks the Certification for Corrugated Pipe Items to insure that the Supplier's name appears on the Approved List. When polymer coated corrugated steel pipe is used, the brand of polymer film and applicator shall also be checked to insure they appear on the Approved List. Inspects material for compliance with specifications (see Section VI). Rejects material not conforming to specifications. Informs Region Materials.
Regional Materials Inspector	5. Inspects material for compliance with specifications (see Section VI). Rejects material not conforming to specifications.
Supplier or Contractor	6. Makes repairs (if allowed) following the repair procedures (see Section VI).
Project Inspector	7. Checks replacement or repairs. If repairs are not acceptable the material shall be rejected and replaced. Informs Region Materials.
Regional Materials Inspector	8. Informs Materials Administration Section of the Materials Bureau of rejections.

CRITERIA FOR INSPECTING STEEL AND ALUMINUM CORRUGATED PIPE AND STRUCTURAL PLATE

The Project Inspector should conduct a limited inspection as the corrugated pipe sections or structural plates are unloaded at the project site or anytime up to the installation of the pipe. The Contractor shall make every section of pipe or structural plate accessible to the Project Inspector for examination in detail. The criteria given in this method shall be used by the Project to judge the acceptability of the pipe or plate.

This criteria for inspecting corrugated pipe and structural plate not only contains a description of possible damage, but describes the defects that are repairable. Defects that are repairable shall be corrected according to the procedures described in this Materials Method.

Corrugated Pipe and Plate

Riveted Pipe - Riveted pipe shall exhibit no uneven deviation from true shape. Uneven laps and ragged edges shall not be allowed. Loose, unevenly aligned or spaced rivets and poorly formed rivet heads are cause for rejection of the pipe. All rivets shall be driven cold in such a manner that the plates shall be drawn together throughout the entire lap. The center of no rivet shall be closer than twice its shank diameter from the edge of the metal. Longitudinal seams shall be riveted with at least one rivet in the valley of each corrugation.

Lock Seams - Lock seams shall exhibit no cracks or repair welds, except a one inch maximum length repair weld at rerolled end only. The lapped surfaces shall be in tight contact and no loosely formed or open seams shall be allowed. Any of the previous defects are cause for rejection of that section of pipe.

Welded Seams - Any indication of cracks, skips or deficient welds found by the Inspector shall be cause for rejection of that section of pipe.

Circular Perforations - Perforations shall be approximately circular and cleanly cut and shall be arranged in rows parallel to the axis of the pipe. The perforations shall be located on the inside crests or along the neutral axis of the corrugations. The rows of perforations shall be arranged in two equal groups placed symmetrically on either side of a lower unperforated segment corresponding to the flowline of the pipe. The spacing of the rows shall be uniform. The distance between the centerlines of rows shall not be less than one inch.

Metallic Coating - The Project Inspector shall examine zinc, aluminum or aluminum-zinc coated steel for defects. Steel coated in accordance with AASHTO specifications should be free of the defects listed as follows:

1. Bare Spots - These defective areas on the pipe or plate result from a lack of adherence by the coating. The spots are recognized by the appearance of red rust which results from corrosion of the uncoated steel.

2. Pimples - These defective areas on the pipe or plate are caused by inclusions of dross (zinc-iron alloy) particles in the zinc coating. Pimples are recognized by a swelled bump in the galvanizing.

3. Wet Storage Stains - These defective areas on the pipe or plate are a result of closely stacked freshly coated articles which become damp during storage. The stains are recognized by the appearance of white rust, a white deposit on the coating.

When directed by the Engineer the Contractor shall repair any damaged coating. Field repair shall be allowed only when the total damaged area on each piece is less than 2 square feet of the coated surface. Any piece with a total damaged area greater than the amount specified above shall be rejected and immediately removed from the worksite. Any rejected piece shall be replaced by the Contractor at no cost to the State. The coating shall be repaired by the following method:

The damaged area shall be cleaned by wire brushing to remove all defective coating and repaired with one brush coat or two spray coats of zinc repair material. The brand of repair material used shall be one which appears on the Department's Approved List.

Polymer Coating - The Project Inspector shall examine polymer coated steel for defects. Steel coated with polymer in accordance with AASHTO specifications should be free of the defects listed as follows:

1. Delaminations - These defective areas on the pipe result from a lack of adherence by the polymer coating. These areas are recognized by the separation of the polymer coating from the steel. These areas shall not be repaired and the pipe shall be rejected.

2. Nicks and Scrapes - These defective areas on the pipe result from shipping and handling of the pipe. These areas are recognized by the appearance of the underlying steel.

When directed by the Engineer the Contractor shall repair any damaged coating. Field repair shall be allowed only when the total damaged area on each piece is less than 2 square feet of the coated surface. Any piece with a total damaged area greater than the amount specified above shall be rejected and immediately removed from the worksite. Any rejected piece shall be replaced by the Contractor at no cost to the State. The coating shall be repaired by the following method:

The damaged area shall be cleaned by wire brushing to remove all defective coating and repaired with two brush coats of polymer repair material. The brand of repair material used shall be one which appears on the Department's Approved List.

Additional Defects - In addition to coating damage, the following defects will be cause for rejecting the pipe when inspected at the project:

In no case shall the difference in diameter of the abutting pipe ends be more than 1/2 inch (See Sketch 1, page 17).

Sharp bends in pipe arch that are less than the specified minimum corner radius for that size (See Sketch 2, page 17).

Variation from a straight centerline shall be not more than 3/4 inch in 20 feet (See Sketch 3, page 17).

Other defects are listed in the Section on "Workmanship" of AASHTO Standard Specification M36 Corrugated Steel Pipe, Metallic Coated, for Sewers and Drains and M245 Corrugated Steel Pipe Polymer Precoated for Sewers and Drains.

BITUMINOUS COATED ROUND CORRUGATED PIPE

The Project Inspector shall measure the thickness of the bituminous paving over the crest of the pipe corrugations. The Department uses four types of bituminous paved pipe:

Fully Bituminous Coated and Paved Invert
Fully Bituminous Coated and 100 Percent Paved
Polymer Coated, with a Bituminous Paved Invert
Polymer Coated, 100 Percent Bituminous Paved

One pipe of ten or less pipes of similar diameter and type of bituminous paving shall be measured for thickness. An average thickness shall be determined by measuring the thickness of the interior asphalt paving over all successive corrugation crests between seams of the pipe and dividing by the number of measurements taken. A nail or other similar sharp probe shall be used to measure the paving depth. The minimum average thicknesses for all types shall be 1/8 inch.

The Project Inspector shall also examine all pipe for consistency of bituminous paving. The paving should be smooth with no corrugations visible. If corrugations appear, the Project Inspector shall measure the pipe coating in those areas using the aforementioned procedure.

CORRUGATION DEPTH OF METAL PIPE AND STRUCTURAL PLATE

The Region Materials Inspector shall measure the depth of corrugations of the pipe and structural plate. One pipe of sixty or less pipes of similar corrugation pattern shall be measured. An average corrugation depth shall be determined by measuring all successive corrugations (excluding rerolled ends) between lockseams of the pipe using the Department's depth guage and dividing by the number of measurements taken. Each measurement shall be the vertical distance from the base of the depth gauge resting on the corrugation crests to the bottom of the intervening valley. The minimum averages shall be as follows:

Corrugation Type	Nominal Inside Diameter (inches)	Corrugation Pattern (inches)	Nominal Depth (inches)	Minimal Depth (inches)	Steel Pipe	Aluminum Pipe
Helical	4 to 18	1 1/2 X 1/4	0.25	0.24	X	X
Helical	12 to 21	2 X 7/16	0.44	0.42	-	X
Helical	12 to 21	2 2/3 X 7/16	0.44	0.42	-	X
Helical	12 to 84	2 2/3 X 1/2	0.50	0.48	X	X
Helical	36 to 120	3 X 1	1.00	0.95	X	X
Helical	36 to 120	5 X 1	1.00	0.95	X	X
Annular	4 to 18	1 1/2 X 1/4	0.25	0.24	X	X
Annular	12 to 84	2 2/3 X 1/2	0.50	0.48	X	X
Annular	30 to 120	3 X 1	1.00	0.95	X	X
Annular	36 to 120	5 X 1	1.00	0.95	X	X

One of twenty or less structural plates of similar corrugation pattern shall be examined. An average corrugation depth shall be determined by measuring all corrugations on the plate and dividing by the number of measurements taken. Each measurement shall be the vertical distance from a straight edge resting on the corrugation crests of the plate, to the bottom of the intervening valley. The minimum average shall be as follows:

Structural Plate Type	Corrugation Pattern (inches)	Nominal Depth (inches)	Minimum Depth (inches)
Steel	6 X 2	2 1/2	2 1/8
Aluminum	9 X 2	2	1 9/10

NOTE: All measurements shall be recorded on the reverse side of Form BR-355 and a copy shall be maintained in the project records.

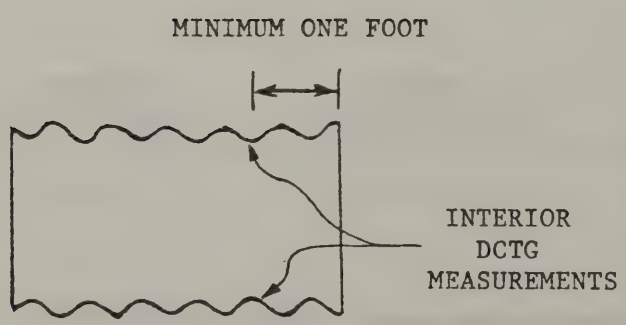
VI. INSPECTION OF PIPE OR PLATE

THICKNESS MEASUREMENT

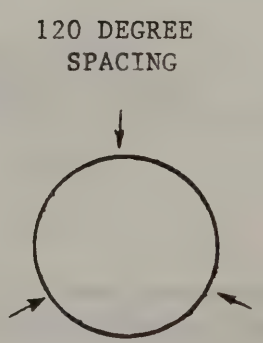
Corrugated Metal Pipe - A pipe is defined as a 20 foot length. The Regional Materials Inspector shall choose one pipe of ten or less pipes of equal diameter and gauge to measure. Three measurements shall be made around the perimeter of the pipe at 120 degree intervals using a micrometer. These measurements shall be made on the tangent (flat spot) of the corrugation in circumferentially (annular) corrugated pipe. In helically corrugated pipe, the measurements shall be made on the tangent of the rerolled corrugations. The average of these measurements will represent the total pipe thickness. Measurements should be made away from lock seams. If the pipe is bituminous coated, the coating shall be scraped and cleaned until the underlying metal is exposed. The pipe shall then be measured for thickness.

If the pipe is polymer coated, the Regional Materials Inspector shall then make three measurements on the inside and outside of the pipe using the digital coating thickness gauge (DCTG). These measurements shall be done at the same location around the perimeter as the total pipe thickness measurements, and at least one foot from the end of the pipe. Because the rerolling procedure may compress the polymer coating and result in a non-representative reading, the polymer thickness is determined from the interior measurement. Measurements shall include any type metallic coating thickness, a polymer exterior coating (nominal 0.003 in. thick, minimum 0.0025 in thick) and an interior polymer coating (nominal 0.010 in. thick, minimum 0.009 in. thick).

From the above measurements the Regional Materials Inspector can determine if the pipe meets specifications.



POLYMER COATING
THICKNESS MEASUREMENT
LOCATIONS

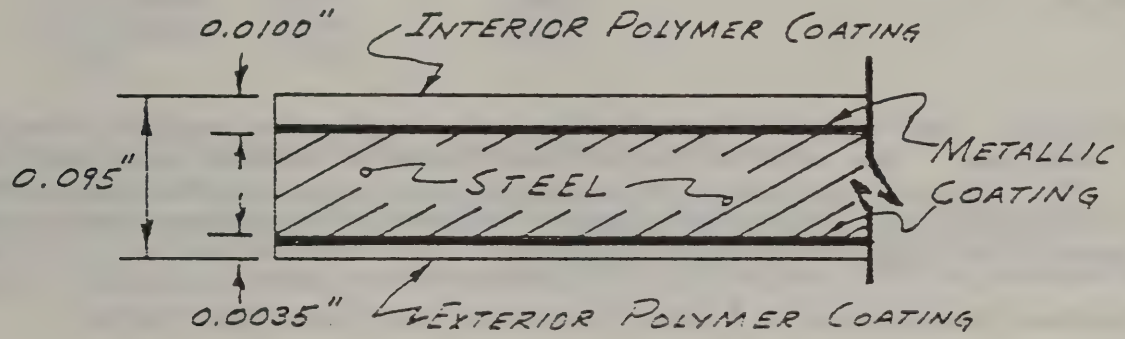


PERIMETER
THICKNESS MEASUREMENT
LOCATIONS

Sample Thickness Measurements of a 14 gauge polymer coated corrugated steel pipe (0.010 inch nominal thickness polymer coating on inside of pipe, 0.003 inch nominal thickness coating on outside).

Perimeter Measurements:
Polymer + Steel + zinc coating = 0.095 in. average micrometer measurement
Interior Polymer + zinc coating = 0.0100 in. average DCTG measurement
Exterior Polymer + zinc coating = 0.0035 in. average DCTG measurement

Metallic coated steel thickness:
0.095 - 0.010 - 0.0035 + 0.003 (zinc thickness both sides) = 0.0845
0.0845 greater than 0.072 (see TABLE 1), meets specification.

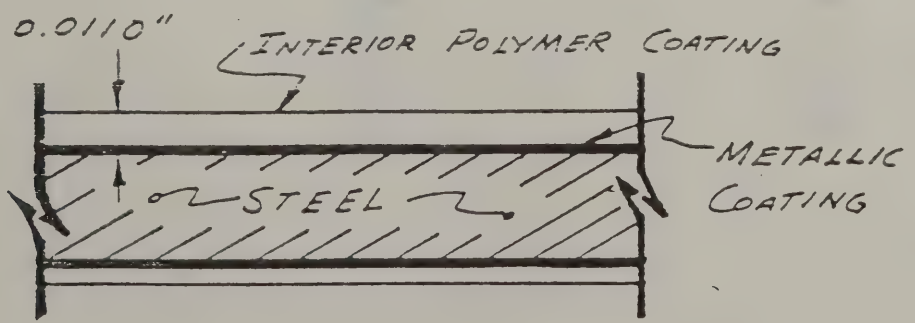


CROSS SECTION OF PIPE WALL

Measurements one foot from edge:

Polymer + zinc coating = 0.0110 in. average DCTG measurement
Minimum polymer coating thickness 0.0110 in. - 0.0015* in. = 0.0095 in.
Specified minimum polymer coating thickness - 0.009 in.
0.0095 in. greater than 0.009 in., therefore coating meets thickness requirement.

*Zinc coating thickness assumed to be 0.0015 in./side



CROSS SECTION OF PIPE WALL

Coupling Bands - The Region Materials Inspector shall examine coupling bands for thickness. One band of ten or less bands of similar diameter and gauge shall be examined. Three measurements shall be made around the perimeter of the band with a micrometer. From these measurements the Inspector can determine the average band thickness. In all cases the sample band shall not be more than two normal gauge thicknesses thinner than the thickness of the pipe to which it is to be connected. In no case shall the band be thinner than:

Band Type	Nominal Thickness (Inches)	Minimum Thickness (Inches)
Galvanized	0.052	0.046
Aluminum-Coated (Type 2)	0.052	0.046
Aluminum-Zinc	0.052	0.046
Aluminum	0.052	0.045

Structural Plate - The Regional Materials Inspector shall also examine structural plate for thickness. One plate of ten or less plates of similar gauge shall be measured. The Inspector shall make three random measurements on the tangent (flat spot) of the corrugations using a micrometer. From these measurements the Inspector can determine if the plate meets specifications.

Sample Thickness Measurements of 8 gauge corrugated steel structural plate

Random Measurements:
Steel and zinc coating 0.160 in. average micrometer measurement
Specified minimum thickness 0.156 in. (see TABLE 2).
0.160 in greater than 0.156 in., therefore steel meets thickness requirement.

NOTE: All measurements shall be recorded on the Form BR-355 and a copy shall be maintained in the project records.

TABLE 1

MINIMUM THICKNESS FOR ROUND CORRUGATED STEEL PIPE AND CORRUGATED STEEL PIPE ARCHES[1]

Gauge	Nominal Thickness (inches)	Minimum Thickness[2] (inches)	Zinc Coated Steel Pipe[3]	Aluminum Coated Steel Pipe[4]	Aluminum-Zinc Coated Steel Pipe[5]
18	0.052	0.046	X	X	X
16	0.064	0.057	X	X	X
14	0.079	0.072	X	X	X
12	0.109	0.101	X	X	X
10	0.138	0.129	X	X	-
8	0.168	0.159	X	-	-

1) An "X" indicates thicknesses included in the applicable specification.
2) Includes metallic coating.
3) Weight of aluminum coating, total both sides, 1.0 $oz./ft^2$, approx. 0.0017 in. thickness/side
4) Weight of zinc coating, total both sides, 2.0 $oz./ft^2$, approx. 0.0015 in. thickness/side
5) Weight of aluminum-zinc coating, total both sides, 0.7 $oz./ft^2$, approx. 0.0009 in. thickness/side

MINIMUM THICKNESS OF ROUND CORRUGATED ALUMINUM PIPE AND CORRUGATED ALUMINUM PIPE ARCHES

Gauge Number	Nominal Thickness (inches)	Minimum Thickness (inches)
18	0.048	0.045
16	0.060	0.052
14	0.075	0.072
12	0.105	0.101
10	0.135	0.130
8	0.167	0.158

TABLE 2

MINIMUM THICKNESS FOR CORRUGATED STRUCTURAL STEEL PLATE

Gauge Number	Nominal Thickness (inches)	Minimum Thickness[1] (inches)
12	0.109	0.097
10	0.138	0.126
8	0.168	0.156
7	0.188	0.176
5	0.218	0.206
3	0.249	0.237
1	0.280	0.268

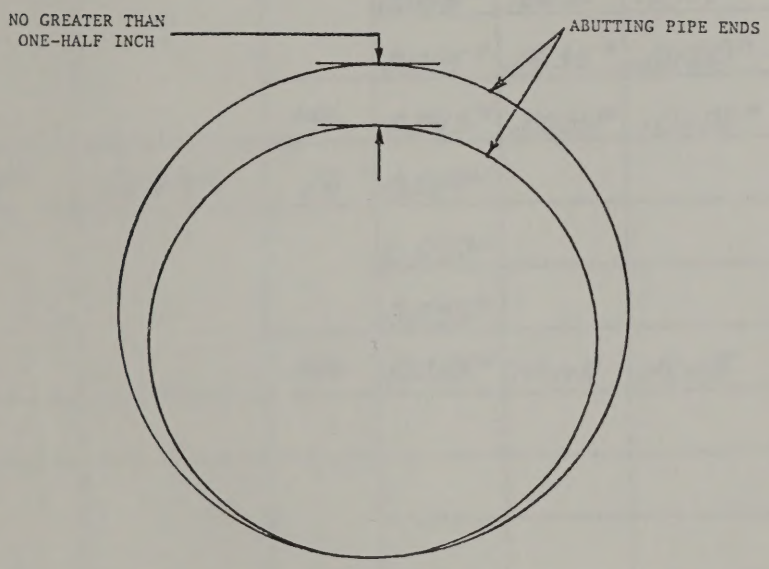
1) Includes zinc coating
12 through 8 gauge, weight of zinc coating, total both sides 2.0 oz./ft^2
7 through 1 gauge, weight of zinc coating, total both sides 3.0 oz./ft^2

MINIMUM THICKNESS OF CORRUGATED ALUMINUM STRUCTURAL PLATE

Nominal Thickness (inches)	Minimum Thickness (inches)
0.100	0.094
0.125	0.118
0.150	0.142
0.175	0.165
0.200	0.190
0.225	0.215
0.250	0.240

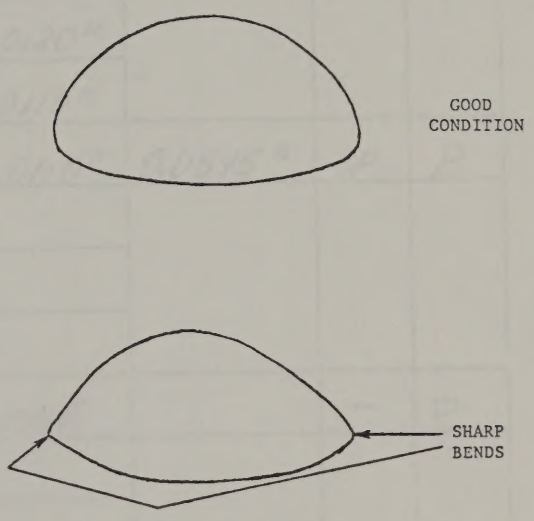
SKETCH ONE

CROSS-SECTIONAL VIEW



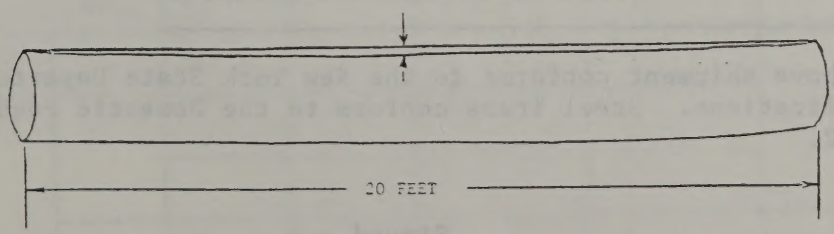
SKETCH TWO

PIPE ARCH



SKETCH THREE

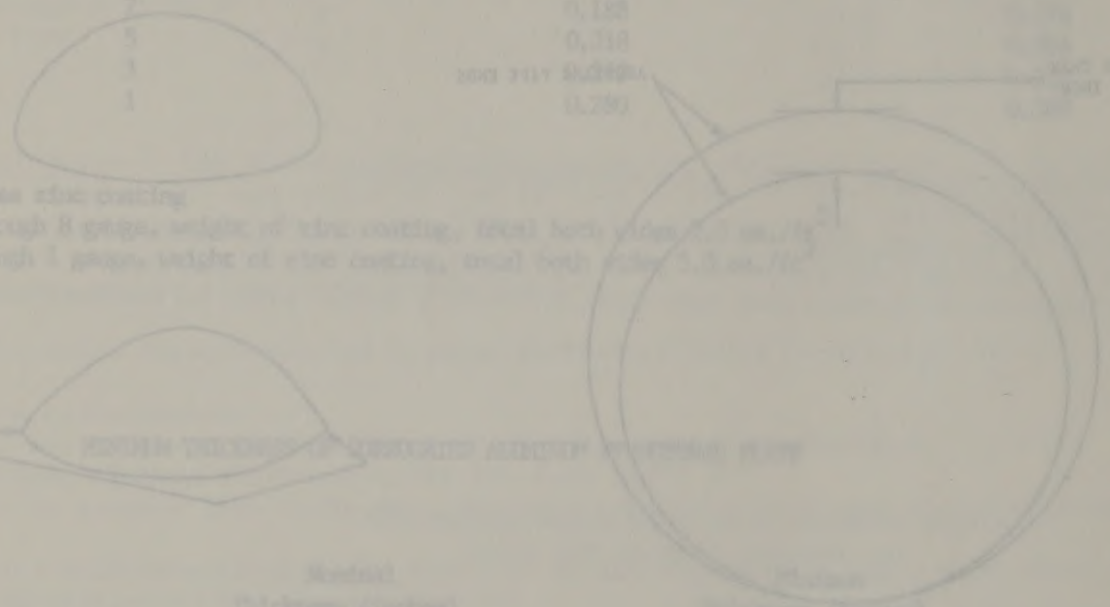
VARIATION FROM A STRAIGHT CENTERLINE SHALL BE NO MORE THAN
3/4 INCH IN TWENTY FEET



CERTIFICATION FOR CORRUGATED PIPE ITEMS

Supplier's Name _____
Location: _____
Department Contract Number: _____
Contractor: _____
Location: _____
Carrier: _____
Trailer Number: _____ Order Number: _____ Shipping Date: _____

ITEM	QUANTITY	SIZE (Diameter and length or type of piece)	GAUGE



Polymer Coating Applicator: _____ Location: _____
Polymer Coating Brand Name: _____
Asphalt Coated and/or Paved by: _____
Location: _____

I certify that the above shipment conforms to the New York State Department of Transportation specifications. Steel items conform to the Domestic requirement defined in Materials Method NY12.

Signed _____
Title _____
Date _____

BR 355 (2/87)

New York State Department of Transportation

MATERIALS BUREAU

THICKNESS MEASUREMENTS OF CORRUGATED METAL PIPE

REGION 4

DATE 3/1/87

INSPECTOR Joe Bushey

JOB STAMP

DIAM.	ITEM NO.	GAUGE	READINGS A TOTAL THICKNESS	B EXTERIOR COATING THICKNESS	C INTERIOR COATING THICKNESS (AT END)	D INTERIOR COATING THICKNESS (ONE FOOT)	E=A+Z*−(B+C) METAL THICKNESS	D PASS FAIL	E PASS FAIL
24"	602.05	14	0.095"	.0035"	.0100"	0.0110"			
			0.096"	.0036"	.0110"	0.0120"			
			0.095"	.0035"	.0100"	0.0110"			
		AVG.	0.095"	.0035"	.0100"	0.0110"	0.0845"	P	P
24"	603.40	16	0.059"						
			0.057"						
			0.058"						
		AVG.	0.058"	NONE	NONE	NONE		−	P
		AVG.							
		AVG.							
		AVG.							

* Z = assumed metallic coating thickness of 0.003 inches, total both sides.

01495
LRI